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BEFORE THE BOARD OF PATENT APPEALS AND INTERFERENCES

Application Number: 10/758,843
Filing Date: January 16, 2004
Appellant(s): WARRIER ET AL.

George A. Coury
For Appellant

EXAMINER'S ANSWER

This is in response to the appeal brief filed October 1, 2009 appealing from the Office action mailed January 5, 2009.

(1) Real Party in Interest

A statement identifying by name the real party in interest is contained in the brief.

(2) Related Appeals and Interferences

The examiner is not aware of any related appeals, interferences, or judicial proceedings which will directly affect or be directly affected by or have a bearing on the Board's decision in the pending appeal.

(3) Status of Claims

The statement of the status of claims contained in the brief is correct.

(4) Status of Amendments After Final

The appellant's statement of the status of amendments after final rejection contained in the brief is correct. In addition, it should be noted that the amendment filed on February 11, 2008 was entered via the Request for Continued Examination filed on March 11, 2008.

(5) Summary of Claimed Subject Matter

The summary of claimed subject matter contained in the brief is correct.

(6) Grounds of Rejection to be Reviewed on Appeal

The appellant's statement of the grounds of rejection to be reviewed on appeal is correct.

(7) Claims Appendix

The copy of the appealed claims contained in the Appendix to the brief is correct.

(8) Evidence Relied Upon

WO 99/13522	WIPO	3-1999
5,702,837	XUE	12-1997
5,064,734	NAZMY	11-1991

DE 19517443 GERMANY 11-1996

(9) Grounds of Rejection

The following ground(s) of rejection are applicable to the appealed claims:

Claims 1, 4, 6, 7, 10, 11, 21, 23, 24, 49, 52, 59, and 60 are rejected under 35 U.S.C. 103(a) as being unpatentable over WO 99/13522 in view of Xue (U.S. Patent 5,702,837).

WO '522 is directed to a solid oxide fuel cell assembly comprising an interconnect assembly comprising a separator plate (122), a silver alloy mesh (136) contacting one side of the plate, and a nickel mesh (144) contacting the other side of the plate (see abstract; Fig. 4). Either the nickel mesh or the silver alloy mesh corresponds to the "compliant interconnect" recited in claims 1 and 49. The side of the mesh contacting the separator is a "first portion" defining a "separator plate contact zone" and the side of the mesh contacting the electrode is a "second portion" defining an "electrode contact zone." The meshes are "superstructures" which comprise a woven substructure, which can be defined as a discrete portion of the superstructure. The silver in mesh 136 may be combined with another material to form a composite or may be formed on stainless steel (see abstract). The mesh is welded to a collector rod which is disposed in a groove in the separator plate, which is then sealed with a glass sealant. Thus, the compliant interconnect is "permanently bonded" to the separator plate as recited in claims 1 and 49. Regarding claims 59 and 60, the anode is a Ni/zirconia cermet and the cathode is strontium doped lanthanum manganite. Regarding claims 1 and 49, these materials have different coefficients of thermal expansion than the silver of the compliant interconnect. Further with regard to claim 23, silver is considered to be a noble metal.

However, WO '522 does not expressly teach that the electrode contact zone of the compliant interconnect is permanently bonded to the electrode, as recited in claims 1 and 49.

Xue is directed to bonding materials for solid oxide fuel cells for anode/anode bonding or anode/interconnect bonding (see abstract).

Therefore, the invention as a whole would have been obvious to one of ordinary skill in the art at the time the invention was made because the artisan would be motivated by Xue to bond the compliant interconnect (i.e., mesh) of WO '522 to the electrode thereof. In column 4, line 62, Xue teaches that "Advantageously, [...] said anode/interconnect bonding material provides strong bonding between anode material and interconnect material with a bond shear strength greater than one megapascal. The strong bonding preserves the integrity and functionality of the SOFC stack against vibration and disturbance occurred during operation." This disclosure would motivate the artisan to bond the electrode of WO '522 to the mesh in hopes of obtaining increased integrity and reduced vibration of the fuel cell stack. Although the mesh is not specifically identified as an "interconnect" in WO '522, it would function as such in the fuel cell. Thus, the teachings of Xue would be relevant to such a structure. Furthermore, a particular known technique (component bonding in SOFC stacks) was recognized as part of the ordinary capabilities of one skilled in the art. *KSR v. Teleflex*, 82 USPQ2d 1385, 127 S. Ct. 1727 (2007).

Claims 1, 4-9, 11-24, 49, 52, 53, 55, 56, and 58-62 are rejected under 35 U.S.C. 103(a) as being unpatentable over Nazmy (U.S. Patent 5,064,734) in view of DE 19517443 in view of Xue.

Nazmy is directed to a solid oxide fuel cell comprising a solid electrolyte (1), an oxygen electrode comprising La/Mn perovskite and a fuel electrode comprising Ni/zirconia cermet (see col. 3, line 40). Interconnects (7, 10) abut each electrode and are in contact with a separator plate (4). Regarding claims 21 and 22, the interconnects can be made of NiCr alloy (see col. 3, lines 56 and 63). Regarding claims 1 and 49, the interconnects thus have a different coefficient of thermal expansion than the electrodes. Regarding claim 23, the interconnects may also comprise a noble metal coating (9) (see col. 3, line 57). Regarding claims 1 and 49, the interconnects are inherently "compliant" and have a "separator plate contact zone" and an "electrode contact zone."

Nazmy does not expressly teach that the compliant interconnects comprise a superstructure which comprises a woven substructure, as recited in claims 1 and 49.

DE '443 is directed to a fuel cell assembly comprising an interconnect assembly comprising a separator plate and current collectors (i.e., "compliant interconnects") contacting the separator plates and anodes (see translation, page 2). The compliant interconnects are nickel-coated stainless steel wire meshes which form square, rectangular, or slanted cross-sectional channels (see Figs. 4a, 4b). The areas of the mesh contacting the separator are "first portions" defining a "separator plate contact zone" and the areas of the mesh contacting the anode are "second portions" defining "electrode contact zones." The meshes are three-dimensional "superstructures," which comprise a woven substructure. It is noted that DE '443 is primarily

directed to molten carbonate fuel cells. However, on page 2 of the translation, it is stated that "thus at [sic] current collectors *to the use in gas cells*, in particular in fusion carbonate gas cells, the following demands are made" (emphasis added).

Accordingly, it is submitted that the artisan would have been motivated to substitute the compliant interconnect of DE '443 for the compliant interconnect of Nazmy. As stated on page 2 of the translation of DE '443, "an advantage according to invention manufactured of the current collector consists of the fact that the mechanical and electrical characteristics can be varied by the choice of the strength and the feather/spring characteristics of the high-grade steel wire as well as by the kind of its processing within a wide range and be adapted to the respective requirements." As such, the artisan would be motivated to use the compliant interconnects of DE '443 in the fuel cell of Nazmy as a way of providing particular mechanical and electrical characteristics in the stack. Further, the substitution of one known element (interconnect of DE '443) for another (interconnect of Nazmy) would have yielded predictable results to one of ordinary skill in the art at the time of the invention. Further, as disclosed in the passage above, although DE '443 is primarily concerned with molten carbonate fuel cells, it is not limited thereto.

Nazmy further does not expressly teach that the compliant interconnects are permanently bonded to the separator plates and electrodes, as recited in claims 1 and 49.

Xue is directed to bonding materials for solid oxide fuel cells for anode/anode bonding or anode/interconnect bonding (see abstract).

Therefore, the invention as a whole would have been obvious to one of ordinary skill in the art at the time the invention was made because the artisan would be motivated by Xue to

bond the current collector (interconnect) of Nazmy as modified by DE '443 to the electrode and separator plate thereof. In column 4, line 62, Xue teaches that "Advantageously, [...] said anode/interconnect bonding material provides strong bonding between anode material and interconnect material with a bond shear strength greater than one megapascal. The strong bonding preserves the integrity and functionality of the SOFC stack against vibration and disturbance occurred during operation." Although Xue discloses the bonding of two components (anode to interconnect), it would be obvious to bond the three components (electrode/ interconnect/separator plate) of Nazmy/DE '443 to obtain the disclosed advantages of preserving integrity and functionality of the SOFC stack. Furthermore, a particular known technique (component bonding in SOFC stacks) was recognized as part of the ordinary capabilities of one skilled in the art. *KSR v. Teleflex*, 82 USPQ2d 1385, 127 S. Ct. 1727 (2007).

Neither Nazmy nor DE '443 expressly teaches that the current collectors are dimpled (claims 8 and 9) or that they define sinusoidal or hourglass-shaped channels or that the connecting portions converge (claims 19, 20, 53, 55, 56, 58), or that the compliance of the current collector is within the ranges defined by claims 12-14.

However, it is submitted that the disclosure of DE '443 fairly suggests the claimed shapes and ranges of compliance. On page 3 of the translation, the reference teaches that "[v]ery different mechanical and electrical characteristics of the current collector can be achieved by the different shaping of the wire mesh, i.e. different contact areas and kiss pressures both on the side to the electrode as well as on that the bipolar plate of the gas cell turned side." Accordingly, this disclosure would motivate the artisan to change the shape of the current collector to affect the mechanical and electrical characteristics. As such, the shapes recited in the instant claims are not

considered to involve an inventive step over DE '443. Additionally, the ranges of compliance recited in claims 12-14 are also not considered to involve an inventive step since the reference suggests modifying the mechanical characteristics and kiss pressure of the current collector.

(10) Response to Argument

Appellants state that "the teachings of Xue relate to the bonding of ceramic to ceramic and this teaching does not carry over to the bonding of a ceramic electrode to metallic interconnect as is the case in the pending application, i.e., the pairs material are different and it is well known in the art that bonding of a ceramic to a metal is a very challenging undertaking and requires materials that can 'couple and react' with the outermost atoms of the metal surface." These arguments are acknowledged; however, the position is maintained that a skilled artisan would have the motivation to make the proposed modification and a reasonable expectation of success in doing so. The stated motivation for making the combination is found in Xue, which is "strong bonding [that] preserves the integrity and functionality of the SOFC stack against vibration and disturbance occurred during operation." Therefore, the artisan would be motivated to bond the electrode with an interconnect (compliant structure) of WO '522, Nazmy, or DE '443 in hopes of obtaining this advantage. Furthermore, there would be a reasonable expectation of success in doing so. Although Xue is primarily directed to ceramic interconnects, this would not dissuade a skilled artisan from attempting to bond non-ceramic components of other fuel cells with the bonding composition of Xue. Additionally, it is submitted that the artisan may appropriately modify the bonding composition of Xue, so long as the resulting bond in the SOFC stack provides increased integrity and reduced vibration of the stack.

On page 11 of the Appeal Brief, the Xue reference is characterized as teaching "the anode part [has] a ceramic material, i.e., nickel oxide and zirconia in the fabrication (prior to reduction which turns nickel oxide to nickel in an operating SOFC)." However, the reference does not teach that the anode contains nickel oxide, as alleged by Appellants. The disclosure of "nickel," i.e., nickel metal at column 1, line 17 is explicit. Accordingly, it is submitted that the anodes of Xue, which are bonded to the interconnects via the inventive composition, contain nickel metal as part of a nickel/zirconia cermet, which indicates to a skilled artisan that the bonding composition is appropriate for bonding at least partially metallic materials. Appellant's argument that the anode of Xue is entirely ceramic is not supported by the reference, nor any other evidence of record.

Regarding Appellant's above-noted argument that "it is well known in the art that bonding of a ceramic to a metal is a very challenging undertaking and requires materials that can 'couple and react' with the outermost atoms of the metal surface," there is no evidence of record to support this assertion. It has been held that the arguments of counsel cannot take the place of evidence in the record. *In re Schulze*, 346 F.2d 600, 602, 145 USPQ 716, 718 (CCPA 1965); *In re Geisler*, 116 F.3d 1465, 43 USPQ2d 1362 (Fed. Cir. 1997); MPEP 2145. Thus, this argument has been given little weight.

Appellants further argue that the ceramic adhesives of Xue are brittle, which would "dictate against a permanent bond to another structure having a different CTE [coefficient of thermal expansion]," and further that "the brittle nature of the ceramics of Xue would not work well with the bonds of the present claims." In response, it is noted that at least in the WO '522 reference, the mesh structures corresponding to the claimed compliant interconnects do not have

a specific function of providing a resilient force within the stack. Thus, such an interconnect does not require a resilient adhesive, and it is seen that the ceramic adhesive of Xue, even if considered to be "brittle," would still be appropriate for bonding to the partially ceramic"Ni/ZrO_2 cermet" anode and entirely ceramic "strontium doped lanthanum manganite" cathode of WO '522 (see page 10, line 3 of WO '522). In addition, as stated above, the skilled artisan would be sufficiently skilled so as to modify the adhesive composition of Xue to provide an optimal composition for a particular application. In this regard, it should be noted that Xue is relied on in a conceptual sense, i.e., that it teaches that adhesives between electrodes and interconnects of solid oxide fuel cells provide advantages such as increased integrity and reduced vibration, rather than for the specific adhesive compositions it teaches.

Furthermore, it is also noted that the specification of the present application ascribes no particular criticality to the bonding of the electrodes/separators with the compliant interconnects. In paragraph [0063] of the specification, it is stated that "in accordance with the present invention, separator plate 24 can advangageously be bonded to anode-side interconnect 32 and cathode-side interconnect 30 through various methods to produce high-strength interfaces therebetween." However, the specification subsequently states, "[f]urthermore, it is within the braod scope of the present invention to position these components adjacent to each other **without any bonding therebetween**" (emphasis added). Thus, it can be seen that the present invention can be made with or without bonds between the components, and such bonding resulting in "high-strength interfaces" further cannot be characterized as a new or unexpected result that would support the patentability of this feature over the combination of prior art references because the references clearly suggest such high-strength interfaces. Accordingly, for these

additional reasons, the rejections as stated above are believed to be proper, and it is respectfully requested that the rejections be sustained.

(11) Related Proceeding(s) Appendix

No decision rendered by a court or the Board is identified by the examiner in the Related Appeals and Interferences section of this examiner's answer.

For the above reasons, it is believed that the rejections should be sustained.

Respectfully submitted,

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